

### **REMARKS**

Applicants respectfully request entry of the foregoing and reconsideration of the subject matter identified in caption, as amended, pursuant to and consistent with 37 C.F.R. § 1.116, and in light of the remarks which follow.

Entry of this response is proper under 37 C.F.R. § 1.116 because the response places the application in condition for allowance (for the reasons discussed herein) or places the application into better form for appeal should an appeal be necessary. The response does not present any additional claims without canceling a corresponding number of finally-rejected claims, does not raise the issue of new matter, and does not raise any new issues requiring additional search and/or consideration since the response is directed to subject matter previously considered during prosecution. Applicants respectfully request entry of the response.

Claims 1-7 and 9-24 are pending in the application.

Applicants thank the Examiner for his consideration of the response filed on March 21, 2006. In addition, Applicants thank the Examiner for the courtesies extended to their representative Martin A. Bruehs during the interview of August 14, 2006. In particular, Applicants thank the Examiner for acknowledging that the claim amendments presented above would overcome the outstanding § 112 issue and place the application into condition for allowance. Applicants also thank the Examiner for agreeing to give favorable consideration to Applicants' position that the proposed amendments should be immediately entered because they do not raise any new issues requiring further search and/or examination.

Turning now to the Official Action, Claims 1-7 and 9-24 continue to be rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. For at least the reasons that follow, withdrawal of the rejection is in order.

The Official Action asserts that the claims are indefinite because they "still do not recite any positive steps for how the recited isocyanates are produced from carbamoyl fluoride." (See Advisory Action at page 2.)

Although Applicants believe that the claims satisfy the requirements of § 112, second paragraph, Applicants have amended the claims to further clarify the subject matter defined therein in an effort to expedite prosecution of the application. In particular, Applicants have amended the claims to further recite that the processes comprise dehydrofluorinating the aromatic carbamoyl fluoride by gradually introducing the aromatic carbamoyl fluoride in a dissolved or finally dispersed state (in some cases with hydrofluoric acid) in a solvent into a solvent heel at a temperature of at least 80°C to obtain the corresponding isocyanate. (Emphasis added.) Because these amendments do not narrow the scope of the claims, the claims should be accorded their full range of equivalents.

In view of the above further clarifying amendments, Applicants submit that the process steps defined in independent Claims 1, 17, 18, 19 and 22 are clear when read in light of the content of the application disclosure, the teachings of the prior art and the claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made. One of ordinary skill in the art having read the disclosure, would readily understand what the legal boundaries of the claims are and would be able to tell with a reasonable degree of certainty whether his or her conduct is within or outside the scope of the claims.

Accordingly, the claims are neither vague nor indefinite under § 112, second paragraph.

Finally, although not binding on the U.S. Patent Office, Applicants wish to point out that the European counterpart application (EP 1189877) was granted by the European Patent Office, even without entry of the above clarifying amendments. For the Examiner's convenience, a copy of EP '877 is attached.

For at least these reasons, Applicants respectfully request reconsideration and withdrawal of the § 112, second paragraph, rejection.

From the foregoing, Applicants earnestly solicit further and favorable action in the form of a Notice of Allowance.

If there are any questions concerning this paper or the application in general, Applicants invite the Examiner to telephone the undersigned at the Examiner's earliest convenience.

Respectfully submitted,

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Attachment: European Counterpart Application EP 1189877

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(54) **PROCEDE DE DESHYDROGENOFLUORATION D'UN FLUORURE DE CARBAMOYLE  
AROMATIQUE**

VERFAHREN DESHYDROGENOFLUORIERUNG VON AROMATISCHEN CARBAMOYLFLUORIDEN  
METHOD FOR DEHYDROGENOFLUORINATION OF AN AROMATIC CARBAMOYL FLUORIDE

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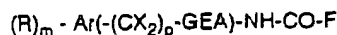
• R. APPEL ET AL.: "Die Reaktion von  
Triphenylphosphin/Tetrachlorkohlenstoff mit  
Carbamoylhalogeniden" CHEMISCHE  
BERICHTE, vol. 107, 1974, pages 2671-2674,  
XP002133040 WEINHEIM DE

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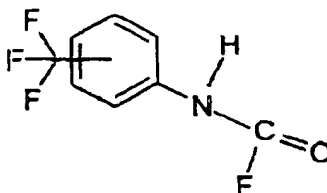
10. Procédé selon les revendications 1 à 9, caractérisé par le fait que le substrat fluorure de carbamoyle comporte un carbone aliphatique c'est-à-dire d'hybridation  $sp^3$  porteur d'au moins deux fluors.
11. Procédé selon la revendication 10, caractérisé par le fait que ledit carbone aliphatique porteur d'au moins deux fluors est benzylique, c'est-à-dire qu'il est directement rattaché à un noyau aromatique.
12. Procédé selon la revendication 11, caractérisé par le fait que ledit noyau aromatique est celui portant l'azote de la fonction carbamoyle.
13. Procédé selon les revendications 1 à 12, caractérisé par le fait que le mélange réactionnel comporte moins de 1 % par rapport au fluorure de carbamoyle initial exprimé en mole d'impuretés présentant un chlore en position benzylique.
14. Procédé selon les revendications 1 à 13, caractérisé par le fait que substrat répond à la formule :



où :

- ☐ Ar et un reste aromatique
- ☐ les X semblables ou différents représentent un fluor ou un radical de formule  $C_nF_{2n+1}$  avec n entier au plus égal à 5 de préférence à 2 ;
- ☐ p représente un entier au plus égal à 2 ;
- ☐ GEA représente un groupe hydrocarboné, un groupe électroattracteur dont les éventuelles fonctions sont inertes dans les conditions de la réaction, avantageusement fluor ou un reste perfluoré de formule  $C_nF_{2n+1}$  avec un entier au plus égale à 8, avantageusement à 5.
- Le nombre total de carbone de  $-(CX_2)_p - GEA$  est avantageusement compris entre 1 et 15, de préférence entre 1 et 10.
- ☐ m est 0 ou un entier choisi dans l'intervalle fermé (c'est-à-dire comprenant les bornes) 1 à 4 ;
- ☐ R représente des radicaux semblables ou différents choisis parmi les halogènes avantageusement légers (c'est à dire chlore et fluor) et les radicaux hydrocarbonés, de préférence alcoyle, aryle, alcoylchalcogényle (tel que alcoyloxy), arylchalcogényle (tel que aryloxy).

15. Procédé selon la revendication 14 caractérisé par le fait que le substrat de départ répond à la formule suivante :



16. Procédé selon les revendications 1 à 15, caractérisé par le fait que les solvants sont choisis parmi les chlorobenzènes, avantageusement monochloro, dichloro et trichlorobenzènes.

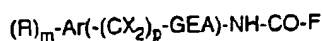
## Claims

1. A dehydrofluorination process for transforming an aromatic carbamoyl fluoride into the corresponding isocyanate, characterized in that it comprises progressively adding carbamoyl fluoride, in the dissolved or finely dispersed state in a solvent, to a seed solvent at a temperature of at least 80°C, advantageously at least 90°C.
2. A process according to claim 1, characterized in that said reaction temperature is at most 150°C.
3. A process according to claim 1 or claim 2, characterized in that said solvent has a boiling point of at least 100°C, advantageously 120°C.

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4. A process according to claims 1 to 3, characterized in that the reaction is carried out at a pressure such that the solvent is boiling at the reaction temperature.
5. A process according to claims 1 to 4, characterized in that the solvent is selected from those which are miscible with hydrofluoric acid, advantageously from halogenated aromatic derivatives which are not reactive with the carbamoyl fluoride.
6. A process according to claims 1 to 5, characterized in that said carbamoyl fluoride is introduced into the solvent with hydrofluoric acid, advantageously in the form of a solution in anhydrous hydrofluoric acid.
7. A process according to claim 6, characterized in that the ratio between the hydrofluoric acid and the carbamoyl fluoride (HF/carbamoyl fluoride) is at least 2, advantageously at least 3, preferably at least 4.
8. A process according to claims 1 to 7, characterized in that addition of the carbamoyl fluoride in the form of a solution is carried out progressively into a seed solvent heated to the selected reaction temperature.
9. A process according to claims 1 to 8, characterized in that addition is carried out at a rate such that the mole ratio between the hydrofluoric acid and the isocyanate (HF acid/aromatic isocyanate) is always less than 0.5, advantageously less than 0.3, preferably less than 0.1.
10. A process according to claims 1 to 9, characterized in that the carbamoyl fluoride substrate comprises an aliphatic carbon, i.e.  $sp^3$  hybridized, carrying at least two fluorines.
11. A process according to claim 10, characterized in that said aliphatic carbon carrying at least two fluorines is benzylic, i.e. directly bonded to an aromatic ring.
12. A process according to claim 11, characterized in that said aromatic ring is that carrying the nitrogen of the carbamoyl function.
13. A process according to claims 1 to 12, characterized in that the reaction mixture comprises less than 1% with respect to the initial carbamoyl fluoride, expressed as the moles of impurities having a chlorine in the benzyl position.
14. A process according to claims 1 to 13, characterized in that the substrate has formula:



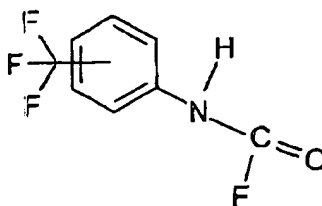
in which:

- the Xs, which may be similar or different, represent a fluorine or a radical with formula  $C_nF_{2n+1}$  where n is an integer of at most 5 and preferably at most 2;
- p represents an integer of at most 2;
- GEA represents a hydrocarbon group, an electro-attractive group any functional groups of which are inert under the reaction conditions, advantageously fluorine or a perfluorinated residue with formula  $C_nF_{2n+1}$  with an integer of at most 8, advantageously at most 5; the total carbon number of  $-(CX_2)_p-GEA$  is advantageously in the range 1 to 15, preferably in the range 1 to 10;
- m is 0 or an integer in the range 1 to 4 (limits included);
- R represents similar or different radicals selected from halogens, advantageously light halogens (i.e. chlorine and fluorine) and hydrocarbon radicals, preferably alkyl, aryl, alkylchalcogenyl (such as alkylthio), arylchalcogenyl (such as arylthio).

15. A process according to claim 1, characterized in that the starting substrate has the following formula:

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16. A process according to claims 1 to 15, characterized in that the solvents are selected from chlorobenzenes, advantageously monochloro-, dichloro- and trichloro-benzenes.

#### 15 Patentansprüche

1. Verfahren zur Dehydrogenfluorierung, welches die Überführung eines aromatischen Carbamoylfluorids zu dem entsprechenden Isocyanat ermöglicht, dadurch gekennzeichnet, daß das Verfahren die fortschreitende Zugabe des in einem Lösemittel im gelösten oder feinverteilten Zustand befindlichen Carbamoylfluorids zu einem Lösemittelbodensatz bei einer Temperatur von mindestens 80 °C, vorzugsweise mindestens 90 °C, umfaßt.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Reaktionstemperatur höchstens 150 °C beträgt.
3. Verfahren nach Anspruch 1 und 2, dadurch gekennzeichnet, daß das Lösemittel einen Siedepunkt von mindestens 100 °C, vorzugsweise 120 °C, aufweist.
4. Verfahren nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß die Reaktion bei einem solchen Druck durchgeführt wird, daß bei der Reaktionstemperatur das Lösemittel siedet.
5. Verfahren nach den Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß das Lösemittel ausgewählt ist aus solchen Lösemitteln, welche mit Fluorwasserstoff (Fluorwasserstoffsäure) mischbar sind, vorzugsweise aus mit dem Carbamoylfluorid nichtreaktiven, halogenierten aromatischen Derivaten.
6. Verfahren nach den Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß das Carbamoylfluorid mit dem Fluorwasserstoff, vorzugsweise in Form einer wäßrigen Lösung in dem wasserfreien Fluorwasserstoff, in das Lösemittel eingetragen wird.
7. Verfahren nach Anspruch 6, dadurch gekennzeichnet, daß das Fluorwasserstoff/Carbamoylfluorid-Verhältnis (HF/Carbamoylfluorid-Verhältnis) wenigstens 2, vorzugsweise 3, bevorzugt 4, beträgt.
8. Verfahren nach den Ansprüchen 1 bis 7, dadurch gekennzeichnet, daß die Zugabe des Carbamoylfluorids in der Form einer Lösung fortschreitend zu einem Lösemittelbodensatz (Lösemittelsumpf) erfolgt, welcher auf die gewählte Reaktionstemperatur gebracht ist.
9. Verfahren nach den Ansprüchen 1 bis 8, dadurch gekennzeichnet, daß die Zugabe mit einer solchen Geschwindigkeit erfolgt, daß das Molverhältnis zwischen Fluorwasserstoff und Isocyanat (Fluorwasserstoffsäure HF/aromatisches Isocyanat) stets kleiner als 0,5, vorzugsweise 0,3, bevorzugt 0,1, ist.
10. Verfahren nach den Ansprüchen 1 bis 9, dadurch gekennzeichnet, daß die Carbamoylfluoridausgangsverbindung einen aliphatischen Kohlenstoff umfaßt, d. h. mit einer  $sp^3$ -Hybridisierung, welcher mindestens zwei Fluoratome trägt.
11. Verfahren nach Anspruch 10, dadurch gekennzeichnet, daß der aliphatische Kohlenstoff, welcher mindestens zwei Fluoratome trägt, benzyllisch ist, d. h. daß er direkt an einen aromatischen Kern gebunden bzw. angeschlossen ist.
12. Verfahren nach Anspruch 11, dadurch gekennzeichnet, daß der aromatische Kern den Stickstoff der Carbamoylfunktion trägt.

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